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INTERIM MEASURE WORK PLAN

CHARACTERIZATION OF CAULK IN CONCRETE PAVEMENTS AT BOEING PLANT 2

Boeing Plant 2
Seattle/Tukwila, Washington

RECEIVED
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Office of Air Waste & Toxics

Prepared for:

The Boeing Company
P.O. Box 3707, M/C 1W-12
Seattle, Washington 98124

August 2007

Prepared by:

Golder Associates Inc.
18300 NE Union Hill Rd, Suite 200
Redmond, Washington 98052

FINAL

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

Attachment A: Table 1: Summary of Historical Caulk PCB Sampling Results, 2-60s / 2-66 Area
Attachment B: Sampling and Analysis Plan

1.0 INTRODUCTION

This Interim Measure (IM) Work Plan has been prepared on behalf of The Boeing Company (Boeing) for the Plant 2 facility in Seattle/Tukwila, Washington. This IM Work Plan has been prepared, and the planned IM will be performed, in accordance with Administrative Order on Consent (Order) No. 1092-01-22-3008(h) between Boeing and the Environmental Protection Agency (EPA) Region X. The Order is issued pursuant to Section 3008(h) of the Solid Waste Disposal Act, also referred to as the Resource Conservation and Recovery Act (RCRA). This Work Plan is being submitted pursuant to EPA's February 15, 2007 and April 11, 2007 letters, the latter being sent following Boeing's February 26, 2007 letter, and discussions on this subject. In short, the USEPA letters require Boeing to submit an interim measure work plan to identify all polychlorinated biphenyl (PCB) contaminated caulk at the facility with concentrations of PCBs above 1 part per million (ppm). The April 2007 letter specified inclusion of a discussion on the removal of all caulk with PCB concentrations in excess of 50 ppm and the stabilization of all caulk with PCB concentrations between 25 and 50 ppm.

This IM Work Plan describes the sampling protocol that, in conjunction with an assessment of the results of previous caulk sampling, will be used to characterize joint caulk in the outdoor concrete pavements of Plant 2. It then discusses the potential removal or stabilization of caulk having elevated levels of PCBs.

1.1 Background

Plant 2 is located on 109 acres between the Duwamish Waterway and East Marginal Way South in Seattle and Tukwila, Washington (Figure 1). With the exception of small landscaped areas, the ground surface at Plant 2 is either paved or covered by buildings. Stormwater falling upon pavement or buildings is discharged to the Duwamish Waterway under a National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Industrial Activities, in compliance with the State of Washington Water Pollution Control Law (Chapter 90.48 RCW) and the Federal Water Pollution Control Act (The Clean Water Act) (Title 33 United States Code, Section 1251 et seq.).

1.2 Description of Plant 2 Pavements and Slabs

The outdoor pavements at Plant 2 have been divided into five geographical areas for the purpose of this IM Work Plan (Figure 2). The five geographical areas include the South Yard, the 2-60s/2-66 Area, the 2-40 Area, the 2-10 Area and the North Area. The outdoor surfacing in the South Yard comprises an area of approximately ten acres, and consists primarily of recent asphalt with little or no caulk material. A small area near the SCL Transformer pad is concrete that will be replaced with asphalt when that space is remediated. The outdoor surfacing in the 2-60s/2-66, 2-40, and 2-10 Areas comprise a combined area of approximately 29 acres, and consists primarily of older, jointed and/or cracked concrete with caulk material in the joints and/or cracks. Caulk materials from the concrete pavements and building slabs in the 2-60s/2-66 Area were sampled previously, and those data are discussed and applied in this present Work Plan. The outdoor surfacing in the North Area comprises an area of approximately 13 acres, and consists primarily of recent asphalt with little or no caulk material. Refer to the table presented on Figure 2 for detailed estimates of the pavement areas and joint lengths at Plant 2. On the east side of the 2-20s series of buildings, small paved areas consist of recent concrete and joint materials, and these areas are therefore not the focus of this work plan.

On the east margin of the 2-10 Area the below-grade parking (purchased recently from BOC Gases) is asphalt paved, and caulk has already been removed from within the jet fuel tank bermed area.

Accordingly, and as is described further below, the concrete pavements and slabs in the 2-60s/2-66 Area and the concrete pavements in the 2-40 Area and the 2-10 Area are the focus of this IM Work Plan due to the age and nature of the caulk materials in the joints and cracks of the concrete in those areas.

1.3 Recent Studies and Actions

A survey of the stormwater system to identify PCB- and metals-containing materials that may be present in storm lines was conducted at Plant 2 from August through October of 2005 (Floyd|Snider, 2005). The results of this survey (tabular data only) are included as Attachment A. The survey was conducted in two phases. Eight storm lines that together drained most of the paved portions of Plant 2 were selected for the initial phase (Tier 1) of the survey, in which a sample of accumulated solids was collected from the furthest downgradient structure associated with each line (i.e., the last catchment along the main trunk line prior to the outfall). At catch basins containing inserts, or retrofitted traps for accumulation of solids, samples were collected from both the insert and the catch basin bottom. If PCBs were detected at a screening concentration exceeding 1 ppm in a Tier 1 sample, additional (Tier 2) samples were collected from upgradient catchments along that line.

Tier 1 results indicated that concentrations of PCBs were greater than 1 ppm in stormlines X, Y, and I, with lines X and Y having significantly elevated PCB concentrations. Lines X & Y provided drainage for the 2-60s and 2-66 Areas of Plant 2 and line I provides drainage for a large portion of the 2-10 Area (Figure). These three lines were identified for Tier 2 sampling. Tier 2 samples indicated that solids in the most upgradient catch basins along lines X and Y contained PCBs. Tier 2 results indicated that Line I, in comparison, had minimal PCBs throughout its length. All catch basins associated with lines X and Y were cleaned of solids in August (Tier 1 structures), and November (Tier 2 structures) of 2005.

Between October 2005 and April 2006, following identification of PCBs in Lines X and Y, Boeing voluntarily investigated caulking materials that had been applied to joints in paved roadways and concrete slabs in the drainage area served by Lines X and Y (2-60s and 2-66 Areas). The investigation was conducted to provide an indication of whether joint caulk materials may have been a possible source of PCBs. Inspection of these areas revealed multiple applications of a variety of caulk materials used to seal cracks and seams in the roadways and building slabs. Sample locations were selected based on their variability of joint materials and the relative amount of joint material present. Forty-six caulk samples, representative of the numerous types of caulk material (based on appearance) observed in the area, were collected during this investigation. The physical characteristics of the joint materials were recorded for each sample location, and the samples were sent to an analytical laboratory for testing. Results for PCBs ranged from non-detect (0.79 ppm) to 40,500 ppm. A summary of the results of this investigation is presented as Table 1 in Attachment A. As shown on Table 1, PCB concentrations in caulk used in concrete pavement areas were significantly lower than concentrations in the caulk used in the 2-60 series building slabs. Additional review and evaluation of these data and related field sampling sheets will be performed for characterization purposes as part of this IM Work Plan.

In March 2006, installation of a temporary stormwater collection and treatment system was completed to replace the drainage capacity of lines X and Y. This construction activity resulted in the temporary sealing at the surface of all the catch basins and manholes on the X and Y lines to remove those lines from service, and the installation of new drains, lines, asphalt swales and a modern treatment vault which conveys stormwater into stormwater line Z. Line Z is immediately south of the X and Y lines. In October 2006 following a video survey, the catch basins and manholes on the X and Y lines in the 2-66 Area were backfilled with controlled density fill (CDF) and the accessible outfalls for those lines were sealed at the waterway. In March 2007, Boeing began removing the X and Y lines from the 2-60s area of Plant 2 (east of the 2-66 Area).

2.0 OBJECTIVE OF INTERIM MEASURE

The objective of this IM Work Plan is to first develop a baseline characterization of caulk materials in the outdoor concrete pavements at Plant 2. The baseline characterization will include correlation of physical properties (i.e., appearance and texture) of the caulk to PCB concentrations in the caulk. The physical properties will then be used to identify and determine required actions for caulk materials containing concentrations of PCBs above 1 ppm in the concrete pavements throughout Plant 2.

3.0 CAULK IN PAVEMENTS

The surfaces in the South and North Areas of Plant 2 are of asphalt installed during redevelopments over the last fifteen years or so. The age of the asphalt, and the general absence of joints or seams and the caulk material that would fill them, eliminate those Areas from detailed consideration in this IM Work Plan. Accordingly, this Plan is focused on the three generalized areas of Plant 2 in which caulk has been used in the joints and/or cracks in concrete pavements: the 2-60s/2-66 Areas, the 2-40s Area and the 2-10 Area.

A review of historical photographs of Plant 2 indicated that these areas were not constructed at the same time. The 2-40s Area was constructed approximately during 1940/1941, the 2-60s/2-66 Area was constructed approximately during 1942, and the 2-10 Area was constructed approximately during 1953. Given the different periods of construction, it is unknown whether the same caulk materials were used initially in each area during construction. However, it is likely that the caulk materials subsequently used for maintenance purposes in the following decades were the same or similar in each of these areas. As such, we hypothesize that while the original caulks used for construction may vary from area to area, the maintenance caulks are likely common between each of the areas.

A systematic approach is being proposed for developing a baseline characterization of the caulk types in the three subject areas of Plant 2. Existing caulk data from the 2-60s/2-66 Area will be reviewed and evaluated to determine the physical appearances that can be used to identify caulks containing elevated concentrations of PCBs. A caulk sampling and analytical testing program will be conducted on caulks in the 2-40 and 2-10 Areas, and the data will be reviewed and evaluated with the same objective of establishing the visual properties that can be used to identify caulks containing elevated concentrations of PCBs. Caulk types will initially be evaluated and characterized separately by area, then collectively for all three areas.

3.1 Review/Evaluation of Existing Data, 2-60s/2-66 Area

As indicated in Section 1.3, Boeing conducted an investigation of the caulk in concrete pavements and slabs in the 2-60s/2-66 Area of Plant 2 between October 2005 and April 2006. Forty-six caulk samples were collected during this investigation to provide an indication of whether the caulk could potentially have been a source of the PCBs detected in the stormwater system. Samples were collected based upon physical appearance, with the greatest number of samples representing the most predominant caulk types observed in the area. Numerous types of caulk were identified in the sample set. The physical properties of each sample were recorded on field sampling sheets, and included such properties as color and texture for both weathered and fresh-cut surfaces of the caulk. Analytical results for the samples indicated PCB concentrations ranging from non-detect (0.79 ppm) to 40,500 ppm, the higher values being consistently associated with building slab caulk applications. A summary of the analytical results is presented in Table 1 of Attachment A. The physical properties of the caulk materials recorded on field sampling sheets and the PCB concentrations provided in Attachment A will be reviewed and evaluated for characterization purposes.

The data set for the forty-six caulk samples will be sorted by physical and chemical properties to enable an evaluation of similarities between the caulk types. The intent of the sorting is to establish the visual properties that can be reliably used to distinguish caulks with varying levels of elevated PCB concentrations from those caulks with PCB concentrations less than or equal to 1 ppm. Statistical analyses and/or additional sampling may be conducted if needed to increase the level of confidence in the conclusions of this evaluation.

3.2 Characterization of Caulk, 2-40 and 2-10 Areas

3.2.1 Grid System

A grid system of north-south and east-west trending lines will be established on maps of the 2-40 and 2-10 Areas of Plant 2 for the purpose of sampling and characterizing the caulk in the concrete pavements. The grid lines will have a spacing of 75-feet, and will form a series of 75-foot square blocks, each with an area of 5,625 square feet. Each block in each area will be assigned a unique identification number. The 2-40 and 2-10 Areas will have approximately 30 and 85 blocks, respectively.

3.2.2 Sampling

Ten of the blocks in the 2-40 Area and ten of the blocks in the 2-10 Area will be randomly selected for caulk characterization and sampling, using a random number generating program. In each of the ten selected blocks in each of the two areas, the caulk types will be physically characterized based on color and texture of both weathered and fresh surfaces. Samples will be collected of each caulk type observed in each of the blocks, and the samples will be submitted to an analytical laboratory for PCB analysis. This process is intended to provide a representative sample population of the physical and chemical (PCB) characteristics of the caulk types observed in each the 2-40 and 2-10 Areas.

3.2.3 Physical Properties and Analytical Data

The data for the samples from each the 2-40 and 2-10 Areas will be sorted by physical and chemical (PCB) properties to enable an evaluation of trends or similarities between the properties. The intent of the sorting is to establish the visual properties that can be reliably used to distinguish caulks with elevated PCB concentrations from those caulks with PCB concentrations less than or equal to 1 ppm. Statistical analyses and/or additional sampling may be conducted if needed to increase the level of confidence in the conclusions of this evaluation.

3.3 Plant 2 Baseline Characterization

The data from the caulk samples collected in the 2-40 and 2-10 Areas will be combined with the data from the caulk samples in the 2-60s/2-66 Area to enable further evaluation of the data sets as a whole. The objective of combining the data from the different areas is to determine whether the same caulk materials were used in the different areas of Plant 2. This task is intended to result in a reduction of the number of caulk materials being evaluated, ultimately simplifying the visual identification of caulks containing concentrations of PCBs above action levels.

Based upon the results of the collective evaluation of caulks from the 2-60s/2-66, 2-40, and 2-10 Areas, the identified caulk types will be grouped by visual properties and PCB concentrations into categories as follows:

- Caulks with PCB concentrations ≤ 1 ppm;
- Caulks with PCB concentrations > 1 ppm and ≤ 25 ppm;
- Caulks with PCB concentrations > 25 ppm and ≤ 50 ppm; and
- Caulks with PCB concentrations > 50 ppm.

In the event that caulk materials with similar physical properties contain varying categories of PCB concentrations between the different areas of Plant 2, the data will be divided into subsets as needed to further define the baseline characteristics of the caulk materials.

3.4 Preliminary Report

As is discussed further in Section 5.1, upon completion of the sampling and baseline characterization of the caulk materials in the concrete pavement and slabs in the 2-60s/2-66, 2-40, and 2-10 Areas of Plant 2, a preliminary report summarizing the characterization will be submitted to EPA for comment before any further actions are implemented.

3.5 Caulk Mapping and Evaluation

Upon receipt of EPA comments and approval of the preliminary report for the baseline characterization of caulk materials; detailed mapping of contaminated caulks, based upon the visual properties established by the baseline characterization, will be conducted in the 2-60s/2-66, 2-40, and 2-10 Areas of Plant 2. The mapping will be required to identify the specific locations of caulk materials containing > 1 ppm PCBs; to enable an evaluation of recent catch basin and stormwater sampling results versus the areas containing caulk with elevated concentrations of PCBs; and to enable recommendations regarding caulk remedies where deemed necessary, including prioritization of the most severely weathered caulk materials that require stabilization / removal.

3.5.1 Detailed Mapping

The baseline characterization of caulk materials will be used to visually identify the concrete pavement/slab joints and cracks containing caulk with > 1 ppm PCBs in the 2-60s/2-66, 2-40, and 2-10 Areas of Plant 2. All caulk materials in the concrete pavements and slabs of the subject areas will be observed, and the locations and types of those materials characterized as containing > 1 ppm PCBs will be marked on a map of the site. The map will be used to further delineate the joints and cracks containing caulks with PCB concentrations between 25 ppm and 50 ppm, and caulks with PCB concentrations exceeding 50 ppm. Regional mapping, as opposed to individual mapping of joints and cracks, may be implemented in areas where the use of the same caulk material is widespread. In the event that previously uncharacterized caulk materials are discovered during the mapping process, the materials will be mapped, sampled, tested for PCBs, and characterized per the baseline characterization process.

Some concrete pavements at Plant 2, particularly the in the 2-60s/2-66 Area, are known to contain caulked cracks and joints that are too tightly spaced to reasonably map individually. In the event that caulks in tightly spaced cracks and joints are deemed to contain > 1 ppm PCBs, such locations will be regionally mapped as opposed to mapping the cracks individually. The mapping will, however, enable identification of the specific locations where the caulk materials contain elevated concentrations of PCBs.

3.5.2 Stormwater System Sampling Versus Caulk Sampling Results

The mapped locations of caulk materials containing elevated concentrations of PCBs will be compared to the results of recent catch basin and stormwater sampling to evaluate determinations as to whether these caulk materials are potentially affecting stormwater quality. A map of the stormwater system will be overlaid on a map of the caulk material results to assist in this evaluation of potential cause-and-effect.

3.6 Reporting

As is discussed further in Section 5.1, upon completion of the detailed mapping and evaluation of caulk materials, a report will be prepared and submitted to EPA. The report will include maps of caulk materials containing the values and action categories of PCB concentrations, a summary of the risk evaluation of caulk materials versus stormwater sampling results, and recommendations of remedies, if any are required. The recommendations may range from “no action” to “stabilization” to “removal”, depending on the results of the evaluation and based on direction specified in EPA’s April 11, 2007 letter. While it is premature to definitively plan and select actions in the absence of caulk data, a consideration of such actions is provided in Section 4.

4.0 DISCUSSION: REMOVAL AND / OR STABILIZATION

EPA's April 11, 2007 letter requesting this IM Work Plan also requested a discussion for the future removal of all caulk with concentrations of PCBs in excess of 50 ppm, and a contingency for the stabilization or removal of all caulk with concentrations of PCBs between 25 and 50 ppm. Specific removal and/or stabilization methods have not yet been determined, as the selection of such remedies will be highly dependent on the quantity and dispersion of the caulk materials that will be determined through this IM Work Plan. A few potential methods for the stabilization or removal of caulk materials are reviewed below.

4.1 Stabilization (25-50 ppm)

Caulk materials characterized as containing PCB concentrations between 25 ppm and 50 ppm may require stabilization in the future. Potential methods of stabilization include the following:

- Application of a layer of hot tar on joints and cracks to seal the caulk material.
- Application of a primer paint layer and then a hot tar layer on joints and cracks to seal caulk material.
- Application of a "parking lot seal coat" over pavements containing tightly spaced joints and cracks.
- Application of a thin layer of asphalt over pavements containing tightly spaced joints and cracks.

For any stabilization measures indicated above, the development and implementation of an Operation and Maintenance Plan (O & M Plan) will be required for monitoring and repairing stabilized areas.

4.2 Removal (>50 ppm)

Caulk materials characterized as containing PCB concentrations greater than 50 ppm may be designated for removal. Potential methods of removal include the following:

- Manual removal of caulk from joints and cracks using gouging techniques, employing hand tools such as pry bars, chisels, and grinders.
- Mechanical removal of caulk from joints and cracks using high pressure water jetting techniques.
- Mass demolition of slab areas containing caulk in tightly spaced joints and cracks.

In areas where redevelopment activities may require the demolition of pavements within the next few years, temporary stabilization of caulk materials containing > 50 ppm PCBs will be considered to assure effective coordination with any redevelopment demolition plans. In these instances, stabilization methods would likely be similar to those discussed in Section 4.1.

5.0 REPORTING

Two reports will be issued as a result of this IM Work plan, including a preliminary report and a final report.

5.1 Preliminary Report

A preliminary report will be submitted to EPA for comment upon completion of the sampling and baseline characterization of the caulk materials in the concrete pavement and slabs in the 2-60s/2-66, 2-40, and 2-10 Areas of Plant 2, as described in Sections 3.1 through 3.4 above. The report may include statistical analyses and/or additional sampling conducted to increase the level of confidence in the conclusions of the evaluation, as indicated in Sections 3.1 and 3.2.3. The preliminary report will summarize the results of the sampling and baseline characterization, and will establish the visual properties that will be used in the 2-60s/2-66, 2-10, and 2-40 Areas to identify caulk materials with PCB concentrations > 1 ppm and ≤ 25 ppm, caulks with PCB concentrations > 25 ppm and ≤ 50 ppm; and caulks with PCB concentrations > 50 ppm.

5.2 Final Report

Upon receipt of EPA comments and approval of the preliminary report for the baseline characterization of caulk materials and approach, detailed mapping of contaminated caulks will be conducted in the 2-60s/2-66, 2-40, and 2-10 Areas of Plant 2, as described in Section 3.6 above. The results of the detailed mapping will be presented in a final report to EPA. The report will include maps of caulk materials containing the categories of PCB concentrations as follows:

- ≤ 1 ppm
- > 1 ppm and ≤ 25 ppm,
- > 25 ppm and ≤ 50 ppm, and
- > 50 ppm

The final report will include a discussion of caulk evaluation results and detailed action recommendations, if any, for addressing caulk materials.

6.0 SCHEDULE

The IM Work Plan consists of two main phases. Phase 1 includes a review of existing caulk data from the 2-60s/2-66 Area, the sampling and characterization of caulk from ten randomly selected blocks in each the 2-40 and 2-10 Areas, and the submittal of a preliminary report to EPA summarizing the results of this baseline characterization. Phase 2 includes detailed mapping of caulk materials throughout the 2-60s/2-66 Area and in all blocks in the 2-40 and 2-10 Areas based upon the characterization established in Phase 1, sampling of additional caulk materials identified during the course of the detailed mapping, and the submittal of a final report to EPA identifying all caulk materials containing greater than 1 ppm PCBs. The schedule for the IM Work Plan is presented below.

Task	Phase	Description	Due Date
1	Phase 1	Submit IM work plan to USEPA.	May 29, 2007
2		Receive USEPA approval.	TBD
3		Prepare base maps for caulk characterization / review existing data.	Begin within 2 weeks after USEPA approval of Work Plan.
4		Sample collection and custody transfer to laboratory for analysis.	Complete within 8 weeks after USEPA approval of Work Plan.
5		Complete laboratory analysis, data validation and database update.	Complete within 12 weeks after USEPA approval of Work Plan.
6		Submit preliminary report (baseline characterization) to USEPA.	Submit within 14 weeks after USEPA approval of Work Plan.
7		Receive USEPA approval of preliminary report.	TBD
8	Phase 2	Conduct detailed mapping of caulk materials.	Complete within 10 weeks after USEPA approval of preliminary report.
9		Collect samples of additional caulk types identified during mapping, complete laboratory analysis, data validation, and database update.	Complete within 14 weeks after USEPA approval of preliminary report.
9		Submit final report.	Submit within 18 weeks after USEPA approval of preliminary report.
10	Phase 3	Prepare IM Work Plan for caulk stabilization / removal.	Submit within 30 days after USEPA approval of final report.

7.0 REFERENCES

Floyd|Snider. 2005. Memorandum: Summary of Recent Storm System Solids Survey and Source Control Sampling at Plant 2. November.

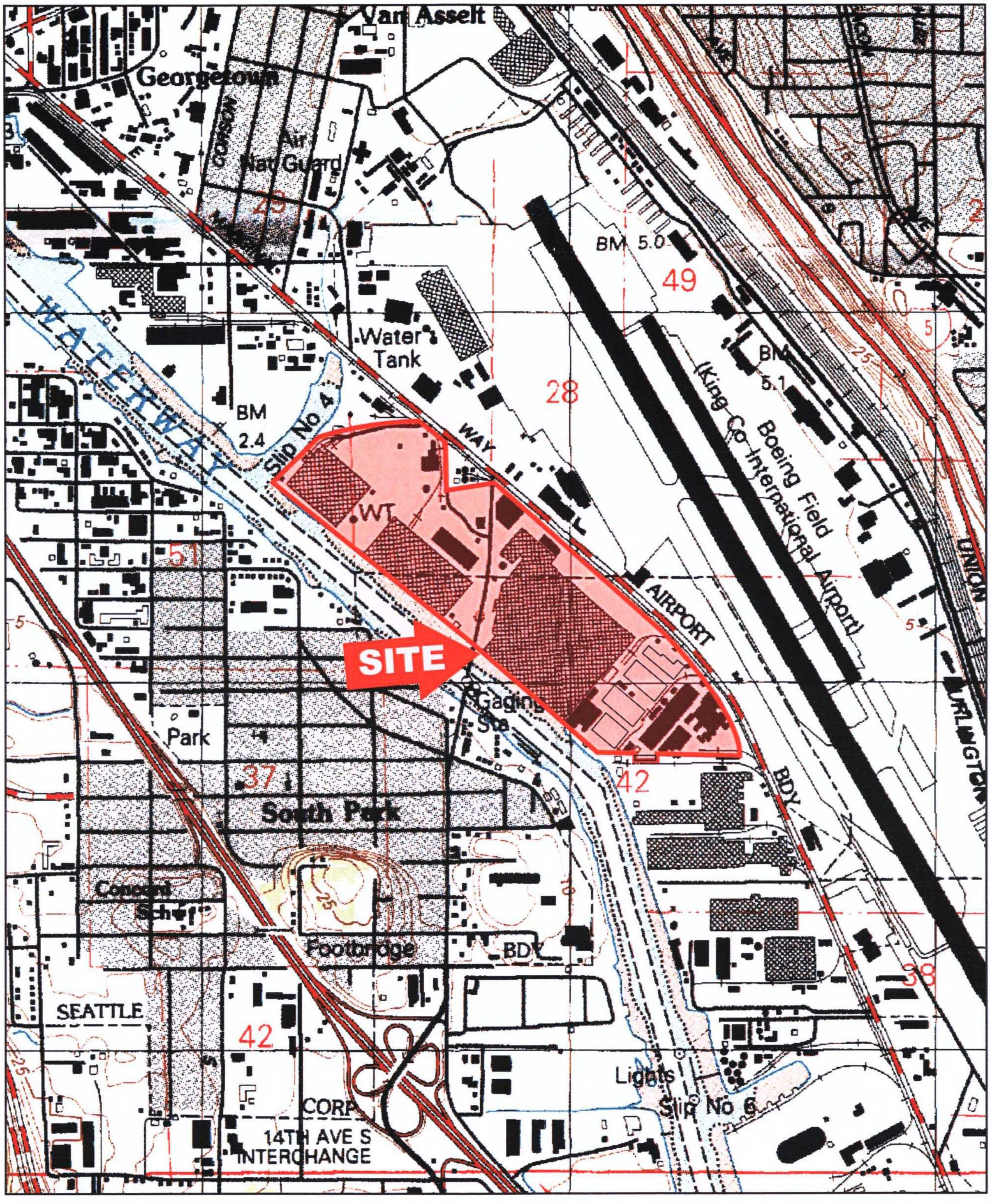
USEPA letter to The Boeing Company, Re: *Determination of the Requirement for an Interim Measure*, EPA ID No WAD 00925 6819. February 15, 2007.

Boeing letter to USEPA, Re: USEPA letter dated February 15, 2007, February 26, 2007.

USEPA letter to The Boeing Company, Re: *Clarification for the Determination of the Requirement for an Interim Measure*, EPA ID No WAD 00925 6819. April 11, 2007.

Figures

FIGURES



Golder Associates	Characterization of Caulk In Concrete IM Work Plan Boeing Plant 2 Seattle/Tukwila, Washington	Figure 1 Vicinity Map

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1 of 1	JDD	SAM	05/17/07

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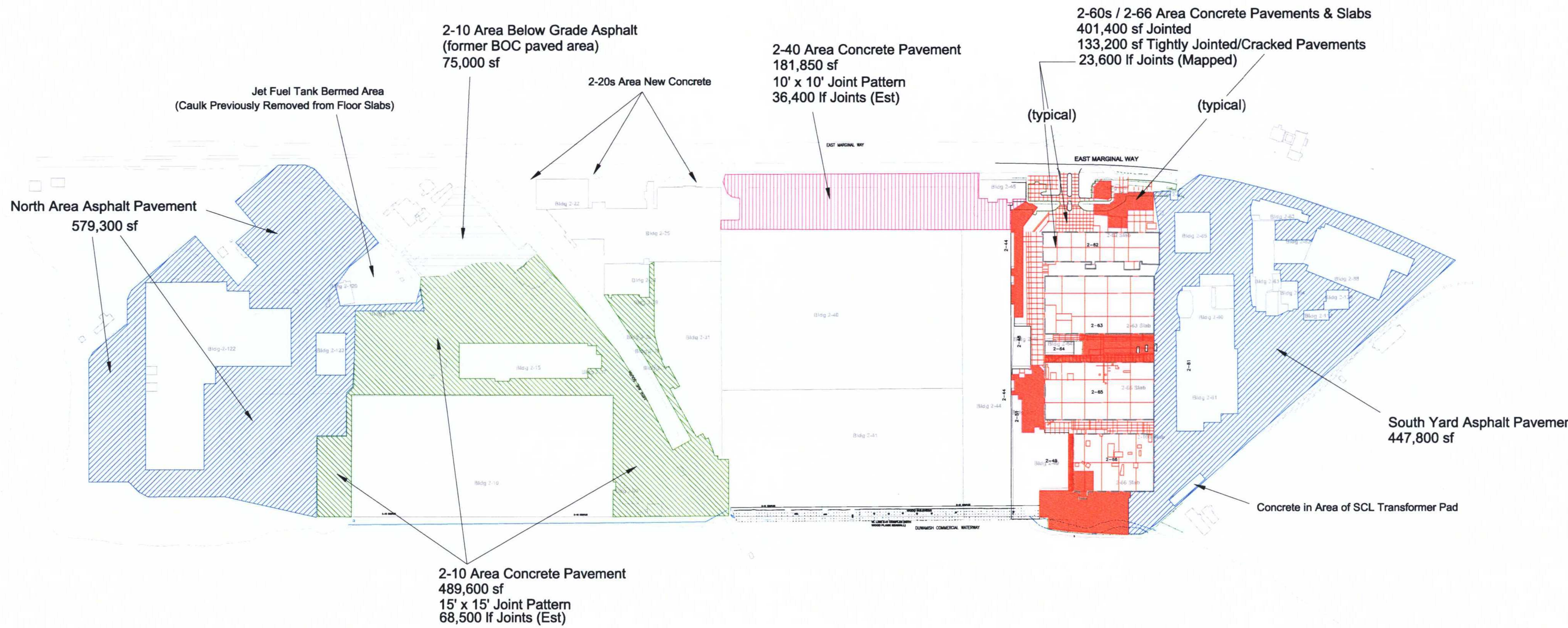

LEGEND

- 2-60s / 2-66 AREA JOINTS IN CONCRETE PAVEMENTS AND SLABS (MAPPED JOINTS)
- 2-60s / 2-66 AREA TIGHTLY JOINTED & CRACKED CONCRETE PAVEMENT
- 2-40 AREA CONCRETE PAVEMENT
- 2-10 AREA CONCRETE PAVEMENT
- 2-10 AREA BELOW GRADE ASPHALT (FORMER BOC PAVED AREA)
- ASPHALT (RECENT PAVING)

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FEET

SUMMARY OF JOINT AND AREA ESTIMATES		
GENERAL LOCATION	AREA (square feet)	JOINT LENGTH (linear feet)
2-60s / 2-66 AREA JOINTED CONCRETE (MAPPED)	401,400	23,600
2-60s / 2-66 AREA TIGHTLY JOINTED/CRACKED CONCRETE	133,200	N/A
2-40 AREA CONCRETE PAVEMENT (EST)	181,850	36,400
2-10 AREA CONCRETE PAVEMENT (EST)	489,600	68,500
2-10 AREA BELOW GRADE ASPHALT - FORMER BOC (EST)	75,000	N/A
NORTH AREA ASPHALT (RECENT PAVING)	579,300	N/A
SOUTH YARD ASPHALT (RECENT PAVING)	447,800	N/A
TOTALS	2,308,150	128,500

Golder Associates

BOEING/PLANT 2 CAULK IM WP

GENERALIZED PLANT 2
PAVEMENTS AND SLABS

FIGURE 2

Attachment A

ATTACHMENT A

SUMMARY OF HISTORICAL CAULK PCB SAMPLING RESULTS, 2-60s / 2-66 AREA

TABLE 1
SUMMARY OF HISTORICAL CAULK PCB SAMPLING RESULTS, 2-60s / 2-66 AREA

				PCBs (µg/kg)															
				PCB Aroclors															
	Location		Sample	1016		1221		1232		1242		1248		1254		1260		Total	
Sample ID	(Pavement or Slab)	Description	Date	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q
PL2-JM-X-215-1	Pavement	Black, with deep cracking	10/5/2005	79,000	U	79,000	U	79,000	U	79,000	U	79,000	U	120,000		620,000		740,000	
PL2-JM-X-215-2	Pavement	Black, with deep cracking	10/5/2005	800	U	800	U	800	U	800	U	800	U	810	J	1,000	J	1,810	J
PL2-JM-X-215-3	Pavement	Black, with deep cracking (MS/MSD collected)	10/5/2005	800	U	800	U	800	U	800	U	800	U	800	U	800	U	800	U
PL2-JM-X-215-4	Pavement	Black, with deep cracking	10/5/2005	790	U	790	U	790	U	2,000	U	4,200		3,900		2,000	U	8,100	
PL2-JM-X-215-5	Pavement	Dark-brown, fibrous, friable	10/5/2005	4,000	U	4,000	U	4,000	U	4,000	U	4,000	U	6,200		7,700		13,900	
PL2-JM-Y-214-1	Pavement	Black, with deep cracking	10/5/2005	800	U	800	U	800	U	800	U	1,500	U	2,500		2,000	U	2,500	
PL2-JM-Y-214-2	Pavement	Black, with deep cracking	10/5/2005	800	U	800	U	800	U	800	U	800	U	2,700		2,000	U	2,700	
PL2-JM-Y-214-6	Pavement	Black, with deep cracking	10/5/2005	790	U	790	U	790	U	790	U	790	U	790	U	790	U	790	U
PL2-JM-Y-214-7	Pavement	White, pliable	10/5/2005	800	U	800	U	800	U	800	U	800	U	800	J	790	J	1,590	J
PL2-JM-Y-214-8	Pavement	Black, with deep cracking	10/5/2005	790	U	790	U	790	U	790	U	790	U	7,300		5,600		12,900	
PL2-JM-Y-214-9	Pavement	White, pliable	10/5/2005	800	U	800	U	800	U	800	U	800	U	1,100		1,600		2,700	
PL2-JM-X-233-1	Pavement	Black, deep cracking	1/23/2006	790	U	790	U	790	U	790	U	790	U	1,200		1,300		2,500	
PL2-JM-Y-226-1	Pavement	Black, deep cracking	1/23/2006	800	U	800	U	800	U	800	U	800	U	960	U	4,000		4,000	
PL2-JM-V-188-1	Pavement	Black soft, pliable	1/24/2006	800	U	800	U	800	U	800	U	800	U	800	U	800	U	800	U
PL2-JM-V-189-1	Pavement	Light gray, pliable	1/24/2006	800	U	800	U	800	U	800	U	800	U	800	U	800	U	800	U
PL2-JM-X-202-1	Pavement	Reddish brown, lightens towards edges	1/24/2006	800	U	800	U	800	U	800	U	800	U	3,800		6,200		10,000	
PL2-JM-X-202-2	Pavement	Yellow-brown, w air pockets, under red brown jm PL2-JM-X-202-1	1/24/2006	800	U	800	U	800	U	800	U	800	U	2,700		3,500		6,200	
PL2-JM-X-235-1	Pavement	Reddish brown, lightens towards edges	1/24/2006	800	U	800	U	800	U	800	U	800	U	2,100		4,200		6,300	
PL2-JM-Z-138-1	Pavement	Black soft, pliable	1/24/2006	790	U	790	U	790	U	790	U	790	U	790	U	2,200	J	2,200	J
PL2-JM-Z-154-1	Pavement	White, pliable	1/24/2006	80,000	U	80,000	U	80,000	U	80,000	U	80,000	U	80,000	U	560,000	U	560,000	U
PL2-JM-Z-154-2	Pavement	Black, deep cracking	1/24/2006	790	U	790	U	790	U	790	U	790	U	790	U	1,400		1,400	
PL2-JM-Z-212-1	Pavement	Black, deep cracking	1/24/2006	790	U	790	U	790	U	790	U	790	U	790	U	1,200	U	1,200	U
PL2-JM-Z-213-1	Pavement	Light, gray, pliable	1/24/2006	800	U	800	U	800	U	800	U	800	U	800	U	800	U	800	U
PL2-JM-Z-706-1	Pavement	Light gray, wrinkled surface	1/24/2006	800	U	800	U	800	U	800	U	800	U	800	U	800	U	800	U
PL2-JM-Z-154-3	Pavement	White, pliable	4/3/2006	40,000	U	40,000	U	40,000	U	40,000	U	40,000	U	40,000	U	400,000	U	400,000	U
PL2-JM-X-215-6	Slab	Dark-brown, fibrous, friable	10/5/2005	4,000	U	4,000	U	4,000	U	4,000	U	4,000	U	5,200		4,000	U	5,200	
PL2-JM-X-215-7	Slab	Black, with deep cracking	10/5/2005	4,000	U	4,000	U	4,000	U	4,000	U	4,000	U	13,000		11,000	U	13,000	
PL2-JM-Y-214-3	Slab	Dark-grey, pliable	10/5/2005	150,000	U	79,000	U	310,000	U	160,000	U	2,300,000	J	27,000,000		4,000,000	U	29,300,000	J
PL2-JM-Y-214-4	Slab	Dark-grey, pliable	10/5/2005	240,000	U	79,000	U	480,000	U	270,000	U	3,500,000	J	37,000,000		4,000,000	U	40,500,000	J
PL2-JM-Y-214-5	Slab	Dark-brown, fibrous, friable	10/5/2005	4,000	U	4,000	U	4,000	U	4,000	U	4,000	U	8,600		8,000	U	8,600	
PL2-JM-X-233-2	Slab	Brown, fibrous, friable	1/23/2006	8,000	U	8,000	U	8,000	U	8,000	U	8,000	U	14,000		13,000		27,000	
PL2-JM-X-220-1	Slab	Dark-brown, stretchy	1/24/2006	18,000	U	18,000	U	18,000	U	18,000	U	18,000	U	18,000	U	55,000	U	55,000	U
PL2-JM-Z-138-2	Slab	Dark-brown, stretchy	1/24/2006	8,000	U	8,000	U	8,000	U	8,000	U	80,000	U	80,000	U	80,000	U	80,000	U
PL2-JM-Z-138-3	Slab	Dark-brown, stretchy (Duplicate for PL2-JM-Z-138-2)	1/24/2006	16,000	U	8,000	U	8,000	U	16,000	U	16,000	U	16,000	U	8,000	U	16,000	U
PL2-JM-Z-212-2	Slab	Brown, fibrous, friable	1/24/2006	21,000	U	8,000	U	48,000	U	24,000	U	32,000	U	110,000		24,000	U	110,000	
PL2-JM-Z-212-3	Slab	Brown, fibrous, friable (Duplicate of PL2-JM-Z-212-2)	1/24/2006	7,900	U	7,900	U	16,000	U	8,700	U	8,700	U	52,000		16,000		68,000	
PL2-JM-Y-214-10	Slab	Brown, fibrous, friable	3/29/2006	4,000,000	U	4,000,000	U	4,000,000	U	4,000,000	U	4,000,000	U	34,000,000		5,000,000	U	34,000,000	
PL2-JM-Y-204-1	Slab	Black to brown, fibrous, friable	4/3/2006	8,000,000	U	8,000,000	U	8,000,000	U	29,000,000		8,000,000	U	8,000,000	U	8,000,000	U	29,000,000	
PL2-JM-Y-225-1	Slab	Black, dull, pliable, friable	4/3/2006	790	U	790	U	790	U	790 U	U	790	U	6,200		7,700		13,900	
PL2-JM-Z-207-1	Slab	Black, dull, stiff, friable	4/3/2006	800	U	800	U	1,200	U	800	U	2,000		4,000		4,300		10,300	
PL2-JM-Z-207-2	Slab	Black, dull, stiff, friable	4/3/2006	790	U	790	U	790	U	1,700		790	U	790	U	790	U	1,700	
PL2-JM-Z-207A-1	Slab	Black, friable, stiff	4/3/2006	800	U	800	U	800	U	800	U	800	U	2,500		1,600		4,100	
PL2-JM-Z-207A-2	Slab	Black, friable, stiff (Duplicate of PL2-JM-Z-207-A-1)	4/3/2006	800	U	800	U	800	U	800	U	800	U	3,000		2,100		5,100	
PL2-JM-Z-207A-3	Slab	Black, dull, stiff, friable	4/3/2006	800	U	800	U	1,200	U	800	U	800	U	3,500		2,100		5,600	
PL2-JM-Z-210-1	Slab	Black, dull, stiff, friable	4/3/2006	4,000	U	4,000	U	4,000	U	3,800 J	J	4,000	U	28,000		14,000		45,800	J
PL2-JM-Z-735-1	Slab	Black to yellow, with a shiny black fresh surface	4/3/2006	8,000,000	U	8,000,000	U	8,000,000	U	39,000,000		8,000,000	U	8,000,000	U	8,000,000	U	39,000,000	

Notes:
J The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample based on diluted concentrations, when available.
U Indicates the compound was undetected at the reported concentration.

Attachment B

ATTACHMENT B

SAMPLING AND ANALYSIS PLAN

ATTACHMENT B: SAMPLING AND ANALYSIS PLAN

INTERIM MEASURE
CHARACTERIZATION OF CAULK IN CONCRETE PAVEMENTS
AT BOEING PLANT 2

Boeing Plant 2
Seattle/Tukwila, Washington

Prepared for:

The Boeing Company
P.O. Box 3707, M/C 1W-12
Seattle, Washington 98124

August 2007

Prepared by:

Golder Associates Inc.
18300 NE Union Hill Rd, Suite 200
Redmond, Washington 98052

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENT A

1.0 INTRODUCTION

The Boeing Company (Boeing) is conducting an interim measure (IM) to characterize caulk materials in concrete pavements at the Plant 2 facility in Seattle/Tukwila, Washington. The IM will be performed under the Administrative Order on Consent (Order) issued to Boeing by the Environmental Protection Agency (EPA) Region X. The IM Work Plan has been prepared pursuant to EPA's February 15, 2007 and April 11, 2007 letters, the latter being sent following Boeing's February 26, 2007 letter, and discussions on this subject. The EPA letters require Boeing to submit an interim measure work plan to identify all polychlorinated biphenyl (PCB) contaminated caulk at the facility with concentrations of PCBs above 1 part per million (ppm).

This Sampling and Analysis Plan (SAP) has been prepared as part of the IM Work Plan, and describes the protocols governing the sampling and analysis that will be conducted to characterize the PCB-contaminated caulk in the concrete pavements at Plant 2. This SAP is structured to comply with the substantive requirements of EPA's Guidance for Quality Assurance Project Plans (EPA, 2002) and Guidance on the Data Quality Objectives Process (EPA, 2006). The relationships between this document, Quality Assurance Project Plans, and the Data Quality Objectives Process are presented in Table 1.

2.0 PURPOSE

The objective of this IM Work Plan is to first develop a baseline characterization of caulk materials in the outdoor concrete pavements at Plant 2. The baseline characterization will include correlation of physical properties (i.e., appearance and texture) of the caulk to PCB concentrations in the caulk. The physical properties will then be used to identify and determine required actions for caulk materials containing concentrations of PCBs above 1 ppm in the concrete pavements throughout Plant 2. Figure 1 presents a general vicinity map of Plant 2, and Figure 2 presents the areas of Plant 2 that are the focus of this IM.

3.0 PROJECT PARTICIPANTS AND RESPONSIBILITIES

3.1 The Boeing Company

Boeing's responsibilities include project direction and oversight, site access and security, profiling and disposal of wastes, space allocation, and other miscellaneous support and planning items.

3.2 Boeing Consultant Team

Golder Associates Inc. (Golder) will be the overall manager for the project. Responsibilities will consist of project oversight, scheduling, field sampling, reporting, and other miscellaneous support items. Data collection activities will be scheduled in coordination with other data gap investigations and source control evaluations to the extent possible for reasons of efficiency. Golder will be responsible for data management, validation, data analysis and reporting.

3.3 Analytical Laboratory

Chemical analyses for all samples will be conducted by Analytical Resources, Inc. (ARI) of Seattle, Washington.

4.0 SAMPLE COLLECTION AND ANALYSIS

In general, samples will be collected and analyzed in accordance with the quality assurance procedures and requirements documented in the July 2003 *Compendium of Sampling and Analysis Plans and Quality Assurance Plans for Boeing Plant 2* (Golder, 2003). Technical procedures have been developed to support sampling, data validation, and other technical activities. Technical procedures applicable to Work Plan tasks are as follows:

- TP 1.2-23 "Chain of Custody"
- SOP 1.3 Sample Control and Decontamination
- SOP 1.5 Guide to Handling, Packaging and Shipping of Samples
- TP 2.2-12 Analytical Data Management

4.1 Sample Collection

During field activities, copies of the relevant technical procedures will be kept onsite for reference. Any significant deviations from the technical procedures will be identified on a Field Change Request form.

4.1.1 Plant 2 Caulk Sampling

A grid system of north-south and east-west trending lines will be established on maps of the 2-40 and 2-10 Areas of Plant 2 for the purpose of sampling and characterizing the caulk in the concrete pavements. The grid lines will have a spacing of 75-feet, and will form a series of 75-foot square blocks, each with an area of 5,625 square feet. Each block in each area will be assigned a unique identification number. The 2-40 and 2-10 Areas will have approximately 30 and 85 blocks, respectively.

Ten of the blocks in the 2-40 Area and ten of the blocks in the 2-10 Area will be randomly selected for caulk characterization and sampling, using a random number generating program. In each of the ten selected blocks in each of the two areas, the caulk types will be visually evaluated for physical properties, primarily based on color and texture of weathered and fresh surfaces.

Samples will be collected of each caulk type observed in each of the blocks. The locations and physical descriptions of each of the samples will be recorded on a Field Sampling Sheet when the samples are collected. An example of a Field Sampling Sheet is presented in Attachment A. Samples will be placed directly into pre-labeled glass jars provided by the analytical laboratory. The sample jars will be placed in an ice chest for temporary storage at approximately 4°C until relinquished under chain of custody to the analytical laboratory (ARI) for PCB analysis by EPA Method 8082. Table 3 provides details on the analytical methods, numbers of samples, containers, preservation and holding times.

The sampling and testing process is intended to provide a representative sample population of the physical and chemical (PCB) characteristics of the caulk types observed in each the 2-40 and 2-10 Areas.

4.1.2 Sample Identification

All samples collected will be assigned a unique identification code based on a consistent sample designation scheme. A sample tracking record will be kept as each sample is collected. Samples will be designated with unique alphanumeric sample identifiers (sample numbers) as follows:

PL2IM-2-AA-NN-C

where:

PL2IM – Plant 2 Interim Measure

AA – Building Area designator, 10 = 2-10 Area, 40 = 2-40 Area.

NN – unique numeric identifier for sample number and location.

C – media for sample (C = caulk).

4.1.3 Analysis Schedule

Table 2 presents a summary of the analyses that will be conducted for this IM, including the estimated numbers of samples, analytical methods and sample requirements.

4.1.4 Field Quality Assurance

Copies of the relevant technical procedures listed in Section 4.0 will be kept onsite for reference during the field investigation. Any significant deviations from the technical procedures will be identified on a Field Change Request form.

Samples will be collected into pre-labeled containers of appropriate volume and type, provided by the laboratory. Samples will be handled using the chain-of-custody procedures in technical procedure (TP) 1.2-23 (Chain of Custody). One duplicate sample will be collected for every twenty samples collected in the field and submitted for similar chemical analyses.

Field sampling notes will be documented on Field Sampling Sheets for each sample collected, and include a description of each location and the sampling methodology applied. Field Sampling Sheets will be reviewed daily by the person recording the data, so that any errors or omissions may be corrected. Original Field Sampling Sheets will be filed, and photocopies will be stored in the main project file. Any data transcribed from the field sheets to electronic form will be checked for transcription error.

4.2 Analytical Laboratory Methods and Quality Assurance

Samples will be analyzed by ARI. The following sections discuss project data quality objectives (DQOs) and lab quality assurance/quality control (QA/QC) requirements for analytical data. Also addressed are data management and validation, as well as the corrective actions necessary if data quality objectives are not met.

4.2.1 Analytical Method Requirements

To achieve IM Work Plan objectives, it is imperative that PCB data is returned at reporting limits below 1 ppm, the concentration above which the EPA requires the identification of all caulk material in the concrete pavements and slabs at Plant 2, as described in the IM work plan. Table 3 presents the analytical methods and reporting limits required for the IM sampling and analysis. The reporting limits represent reasonably achievable levels using the referenced analytical methods.

4.2.2 Quality Objectives and Criteria for Analytical Data

A fundamental objective of field sampling and laboratory analysis is to produce data of known and defensible quality. The objectives for analytical data quality are defined in terms of the data quality indicators (DQIs), precision, accuracy, representativeness, completeness, and comparability.

Precision is the degree of reproducibility or agreement between or among independent or repeated measurements. Precision is assessed via analysis of duplicate samples and laboratory matrix spike/matrix spike duplicates. Accuracy is the agreement between a measured value and the true or accepted value. Analytical accuracy is assessed by comparing the percent recovery of analytes spiked into a laboratory control sample (LCS) to a control limit. For PCBs, surrogate compound recoveries are also used to assess accuracy and method performance. Frequency and acceptance criteria for precision and accuracy are presented in Table 4 for PCB analyses.

Representativeness is the degree to which the data fulfills the investigative objectives. It is achieved through selection of sampling locations and frequencies, and adherence to established field and analytical procedures. Sampling locations and frequencies are identified in Section 4.1.

Comparability is the confidence with which a data set can be evaluated against similar data sets. Comparability is influenced by the variability inherent in field conditions, and is best achieved by consistent application of field and analytical procedures. Thorough field documentation using standardized data collection forms will support the assessment of comparability.

Completeness is the number of valid analyses completed per total number of samples for each analytical parameter, expressed as a percentage. A 90% completeness goal will apply to the IM caulk sampling effort.

4.2.3 Documentation and Records

Laboratory data packages will consist of a case narrative, including descriptions of any problems and corrective actions, copies of the chain-of-custody forms, tabulated analytical results, data qualifiers, and blank and matrix spike results with calculated percent recoveries and differences. If required during the data validation process, more detailed documentation (raw data, analyst's reports, extraction logs, chromatograms, etc.) will be provided upon request.

4.2.4 Quality Control Requirements

Laboratory QC checks include the use of standard EPA analytical methodologies and laboratory QC samples (including analysis of method blanks, spikes, and surrogates). These QC checks are listed in Tables 2 and 4. In addition, analyses will be conducted according to the laboratory's SOPs. Copies of the laboratory SOPs are available upon request.

4.3 Instrument Testing, Calibration, Inspection, and Maintenance Requirements

Analytical instruments shall be calibrated in accordance with the analytical methods as specified in the laboratory QA plan and associated SOPs. All analytes reported shall be present in the initial and continuing calibrations, and these calibrations shall meet the acceptance criteria specified in Table 4. Records of standard preparation and instrument calibration shall be maintained, and calibration standards shall be traceable to standard reference materials.

Instrument calibration shall be checked at the frequency specified in the method. Multipoint calibrations shall contain the minimum number of calibration points specified in the method, with all points used for the calibration being contiguous. If more than the minimum required number of standards is analyzed for the initial calibration, all of the standards analyzed shall be included in the initial calibration. The continuing calibration verification cannot be used as the laboratory control sample.

4.4 Data Management

In addition to the documentation identified in Section 4.2.2, the laboratory will provide an electronic data deliverable (EDD). The format and content of the EDD will be specified by Golder. Validated data will be stored as indicated in TP-2.2-12, "Analytical Data Management". The data storage format will be designed to facilitate reporting and analysis. ARI will maintain the analytical data in electronic format in its Laboratory Information Management System (LIMS).

4.5 Data Review, Validation and Verification

All of the data received from the laboratory will be validated via Level I (basic) review, which consists of the following components:

- Review of sample holding time,
- Verification that sample numbers and analyses matched those requested on the chain-of-custody form,
- Verification that required reporting limits were achieved,
- Verification that field duplicates, matrix spikes, and lab control samples were run at the proper frequency and met QC criteria,
- Verification that the surrogate compound analyses were performed and met QC criteria, and
- Verification that lab blanks were free of contaminants.

Any data that appear defective will be subject to the more comprehensive Level II verification and review in accordance with EPA's Functional Guidelines for Organic/Inorganic Data Review (EPA, 1999 & EPA, 2004). Following this review, data qualifiers assigned by the laboratory may be amended.

4.6 Audits and Corrective Action

ARI participates in Ecology's Laboratory Accreditation Program and has participated in the EPA Contract Laboratory Program. The laboratory is periodically audited by a variety of outside agencies, including EPA, Ecology, and the Washington State Department of Health. Results of recent audits are available from ARI upon request.

Corrective actions will occur if and when the QC limits specified in the methods tables are exceeded. Details of corrective actions are provided in the laboratory SOPs for each method.

Whenever a corrective action does occur, the laboratory manager will be notified. Routine corrective actions will be implemented without notification of the Golder project manager. If the corrective action requires reanalysis or re-extraction, the Golder project manager will be notified.

4.7 Reconciliation with User Requirements

Following receipt of analytical data reports, the Golder project manager will review the sample results to determine whether they meet the data quality requirements in this SAP. If requirements are not met, the Golder and Boeing project managers will decide whether reanalysis must be performed. EPA will be informed of any decision to reanalyze. Depending on the nature of the failure, sample handling, extraction, and instrument calibration and maintenance techniques may be reassessed.

5.0 DECONTAMINATION PROCEDURES

5.1 Sampling Equipment Decontamination

Sampling equipment will include dedicated disposable knife blades and disposable nitrile gloves. Knife blades will be disposed and replaced after each sample is collected, as will the nitrile gloves. Used knife blades and nitrile gloves will be placed daily into DOT-approved steel drums, which must be properly labeled and stored on site pending appropriate disposal by Boeing.

5.2 Decontamination of Workers and Personal Protective Equipment

It is anticipated that all work associated with this IM at Boeing Plant 2 will be conducted in modified Level D protection. Modified Level D protection for sampling caulk materials includes the following components:

- Disposable nitrile gloves
- Steel-toed work boots
- Reflective safety vest
- Safety glasses or equivalent
- Hearing protection if and when appropriate (i.e., while working around blowers or other loud equipment)
- Hard hat (when working around construction or utility equipment, or other overhead hazards)

Personnel will wash their hands and faces with soap and water prior to eating or leaving the site. Nitrile gloves will be discarded as solid waste. Hard hats will be washed when visibly dirty or as needed.

5.3 Decontamination of Sample Containers

All sample containers will be provided by the analytical laboratory, laboratory-prepared and pre-cleaned to standards as required under US EPA SW-846 protocols found in Section 4 of SW-846.

6.0 SAMPLE LOCATIONS AND JOINT MAPPING

Caulk sample locations will be recorded on Field Sampling Sheets and site maps, referencing horizontal locations of such landmarks as catch basins, buildings, or roads to the nearest foot. Subsequently mapped locations of caulk joints and cracks will be similarly referenced horizontally to landmarks, to the nearest foot.

7.0 REPORTING

Two reports will be issued as a result of this IM Work plan, including a preliminary report and a final report. A preliminary report will be submitted to EPA for comments upon completion of the review of existing caulk data from the 2-60s/2-66 Area and sampling and baseline characterization of the caulk materials in the concrete pavement and slabs in the 2-40 and 2-10 Areas of Plant 2, as described in the IM Work Plan. The preliminary report will summarize the results of the baseline characterization and establish the visual properties that will be used to identify caulk materials with PCB concentrations > 1 ppm.

Upon receipt of EPA comments and approval of the preliminary report for the baseline characterization of caulk materials and approach, detailed mapping of contaminated caulks will be conducted in the 2-60s/2-66, 2-40, and 2-10 Areas of Plant 2. The results of the detailed mapping will be presented in a final report to EPA. The report will include maps of caulk materials containing the categories of PCB concentrations as follows:

- > 1 ppm and ≤ 25 ppm,
- > 25 ppm and ≤ 50 ppm, and
- > 50 ppm

The final report will include a discussion of caulk evaluation results and detailed action recommendations for addressing caulk materials. An IM Work Plan for caulk stabilization / removal in the 2-60s/2-66, 2-40 and 2-10 Areas will be prepared after EPA approval of the final report, as indicated in the caulk characterization IM Work Plan.

8.0 SCHEDULE

The baseline testing and characterization of caulk materials in concrete pavement joints at Plant 2 is presently being projected for completion during the fall of 2007. A preliminary report will be submitted to EPA for comment within 2 weeks after completion of the baseline characterization and data validation. Detailed mapping of caulk materials in the concrete pavements and slabs at Plant 2, and additional sampling and testing if needed, will then be conducted, and are currently projected for completion in early 2008. A final report summarizing the results of the detailed mapping will be submitted to EPA within 4 weeks of completion of that work. An IM Work Plan for caulk stabilization / removal will be prepared within 30 days after EPA approval of the final caulk characterization report.

9.0 REFERENCES

Floyd|Snider. 2005. Memorandum: Summary of Recent Storm System Solids Survey and Source Control Sampling at Plant 2. November.

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USEPA letter to The Boeing Company, Re: *Determination of the Requirement for an Interim Measure*, EPA ID No WAD 00925 6819. February 15, 2007.

Boeing letter to USEPA, Re: USEPA letter dated February 15, 2007, February 26, 2007.

USEPA letter to The Boeing Company, Re: *Clarification for the Determination of the Requirement for an Interim Measure*, EPA ID No WAD 00925 6819. April 11, 2007.

TABLES

Table 1: Relationship between data quality objectives (DQO) process, Quality Assurance Project Plan (QAPP), and this Sampling and Analysis Plan (SAP)[1]

QAPP Elements	QAPP Requirements	DQO Overlay	SAP Section Reference
Project Management			
A1 Title and Approval Sheet	Title and Approval Sheet	N/A[2]	N/A
A2 Table of Contents	Document Control Format	N/A	Table of Contents
A3 Distribution List	Distribution list for QAPP revisions and final guidance	List the members of the scoping team. Step 1: State the Problem.	N/A
A4 Project/Task Organization	Identify individuals or organizations participating in the project and discuss their roles, responsibilities and organization.	Step 1: State the Problem requires definition of the DQO scoping of planning team, which includes the decision maker, technical staff, data users, etc. This step also requires the specification of each member's role and responsibilities.	Section 3.0
A5 Problem Definition/Background	1) State the specific problem to be solved or the decision to be made. 2) Identify the decision maker and the principal customer for the results.	Step 1: State the Problem. Step 2: Identify the Decision requires a description of the problem. It also identifies the decision makers who could use the data.	Section 1.0 Section 2.0

A6 Project/Task Description	1) Hypothesis test, 2) expected measurements, 3) ARARs or other appropriate standards, 4) assessment tools (technical audits), 5) work schedule and required reports	Step 1: State the Problem. Step 2: Identify the Decision, requires a work schedule. Step 3: Identify the Inputs, requires the ARARs or standards and expected measurements. Step 6: Specify Limits on Decision Errors.	Section 1.0 Section 2.0. Section 8.0 Section 9.0
A7 Data Quality Objectives for Measurement Data	Decision(s), population parameter of interest, action level, summary statistices, and acceptable limits on decision errors. Also, scope of the project (domain or geographical locale).	Step 1: State the Problem. Step 2: Identify the Decision Step 4: Define the Boundaries. Step 5: Develop a Decision Rule Step 6: Specify Limits on Decision Errors.	Section 1.0 Section 4.2 Section 4.2.2
A8 Special Training Requirements/Certification	Identify special training that personnel will need.	Step 3: Identify the Inputs to the Decision	Site-specific HASP
A9 Documentation and Records	Itemize the information and records that must be included in a data report package, including report format and requirements for storage, etc.	Step 3: Identify the Inputs to the Decision. Step 7: Optimize the Design for Obtaining Data.	Section 4.2.3 Section 4.4

Measurement / Data Acquisition			
B1 Sampling Process Designs (Experimental Design)	Outline the experimental design and rationale, sampling frequencies, matrices, and measurement parameters of interest.	Step 5: Develop a Decision Rule Step 7: Optimize the Design for Obtaining Data.	Section 2.0 Section 4.1.1
B2 Sampling Methods Requirements	Sample collection method and approach.	Step 7: Optimize the Design for Obtaining Data.	Section 4.1 Section 4.1.1
B3 Sample Handling and Custody Requirements	Describe the provisions for sample labeling, shipment, chain-of-custody forms, procedures for transferring and maintaining custody of samples.	Step 3: Identify the Inputs to the Decision.	Section 4.1.1 Section 4.1.2 Section 4.1.4
B4 Analytical Methods Requirements	Identify analytical method(s) and equipment for the study, including method performance requirements.	Step 3: Identify the Inputs to the Decision. Step 7: Optimize the Design for Obtaining Data.	Section 4.2 Section 4.2.1
B5 Quality Control Requirements	Describe routine (real-time) QC procedures that should be associated with each sampling and measurement technique. List required QC checks and corrective action procedures.	Step 3: Identify the Inputs to the Decision.	Section 4.1.4 Section 4.2.2 Section 4.2.4

B6 Instrument/Equipment Testing, Inspection and Maintenance Requirements	Discuss how inspection and acceptance testing, including the use of QC samples, must be performed to ensure their intended use as specified by the design.	Step 3: Identify the Inputs to the Decision.	Section 4.3
B7 Instrument Calibration and Frequency	Identify tools, gauges and instruments, and other sampling or measurement devices that need calibration. Describe how the calibration should be done.	Step 3: Identify the Inputs to the Decision.	Section 4.3
B8 Inspection/ Acceptance Requirements for Supplies and Consumables	Define how and by whom the sampling supplies and other consumables will be accepted for use in the project.	N/A	N/A
B9 Data Acquisition Requirements (Non-Direct Measurements)	Define the criteria for the use of non-measurement data such as data that come from databases or literature.	Step 1: State the Problem. Step 7: Optimize the Design for Obtaining Data.	N/A
B10 Data Management	Outline the data management scheme, including the path and storage of the data and the data record-keeping system. Identify all data handling equipment and procedures that will be used to process, compile and analyze the data.	Step 3: Identify the Inputs to the Decision. Step 7: Optimize the Design for Obtaining Data.	Section 4.4

Assessment/Oversight			
C1 Assessments and Response Actions	Describe the assessment activities needed for this project.	Step 5: Develop a Decision Rule Step 6: Specify Limits on Decision Errors.	Section 4.6
C2 Reports to Management	Identify the frequency, content, and distribution of reports issued to keep management informed.	N/A	N/A
Data Validation and Usability			
D1 Data Review, Validation, and Verification Requirements	State the criteria used to accept or reject data based on quality.	Step 7: Optimize the Design for Obtaining Data.	Section 4.5
D2 Validation and Verification Methods	Describe the process to be used for validating and verifying data, including the chain-of-custody for data throughout the lifetime of the project.		Section 4.5
D3 Reconciliation with Data Quality Objectives	Describe how results will be evaluated to determine if DQOs have been satisfied.	Step 7: Optimize the Design for Obtaining Data.	Section 4.7

[1]Table adapted from Table A.3 in EPA Guidance for Quality Assurance Project Plans (EPA 2001).
[2]N/A – not addressed

Table 2: Laboratory Methods and Sample Requirements

Constituent Group	Laboratory Method	Estimated Number of Samples*	Containers per Sample	Handling and Preservation	Holding Time
Caulk Samples					
Polychlorinated Biphenyls (PCBs)	USEPA 8082	80 caulk samples, 4 equipment blanks, 4 MS, 4 MSD (84 total)	One 2 oz wide-mouth glass jar, TFE lined cap	Stored at 4°C	14 days to extract 40 days to analyze extracts

* Assumes an average of 4 different caulk materials sampled in each of 10 blocks in the 2-10 Area and 10 blocks in the 2-40 Area.

Table 3: Analytical Methods and Reporting Limits

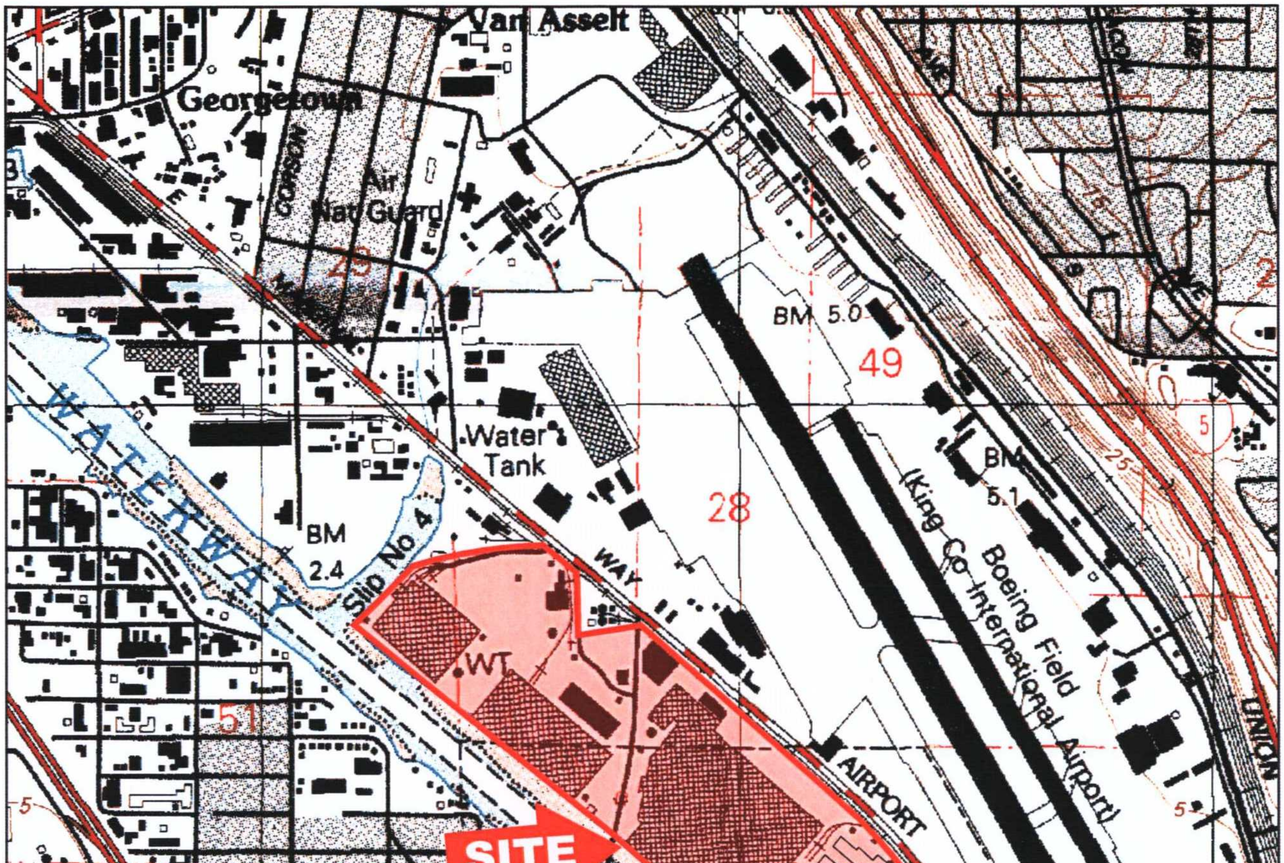
CAS Number	Analytes	Analytical Method	Laboratory RL	Units of Measurement
PCBs				
12674-11-2	Aroclor 1016	8082	800.0	µg/kg
11104-28-2	Aroclor 1221	8082	800.0	µg/kg
11141-16-5	Aroclor 1232	8082	800.0	µg/kg
53469-21-9	Aroclor 1242	8082	800.0	µg/kg
12672-29-6	Aroclor 1248	8082	800.0	µg/kg
11097-69-1	Aroclor 1254	8082	800.0	µg/kg
11096-82-5	Aroclor 1260	8082	800.0	µg/kg
-	Total PCBs	8082	800.0	µg/kg

Table 4: Method Quality Objectives for PCBs (Method 8082)

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria
Initial Calibration		Once every 4 to 8 weeks	r ≥ 0.995, RSD ≤ 20%, r2 ≥ 0.990
Initial Calibration Verification (ICV)	Mid-level (2nd source) verification	After initial calibration	%Recovery = 85% - 115%
Continuing Calibration Verification (CCV)	Mid-level verification	Initial and min of every 12 hrs	%Drift ≤ 15%
Method Blank	Interference-free matrix to assess overall method contamination	1 sample per batch	Analytes < MDL Check Sample (~2X MDL) Clean to 1/2 the RL
Laboratory Control Sample	Interference-free matrix containing all target analytes	1 sample per batch	Solids: %Recovery = 50% - 130%
Matrix Spike (MS)	Sample matrix spiked with all/subset of target analytes prior to digestion	1 sample per batch	%Recovery = 40% - 140%
Matrix Duplicate or Matrix Spike Duplicate	Refer to text for MD or MS	1 sample per batch	RPD = 50%
Surrogates: Interference-Free Matrix Project Sample Matrix		Every sample as specified	Interference-Free Matrix Solids: %Recovery = 50% - 130% Project Sample Matrix %Recovery = 40% - 140%
Target Analyte Confirmation			RPD ≤ 40%

Notes:
1. MDL = method detection limit
2. RPD = relative percent difference
3. RSD = relative standard deviation

FIGURES



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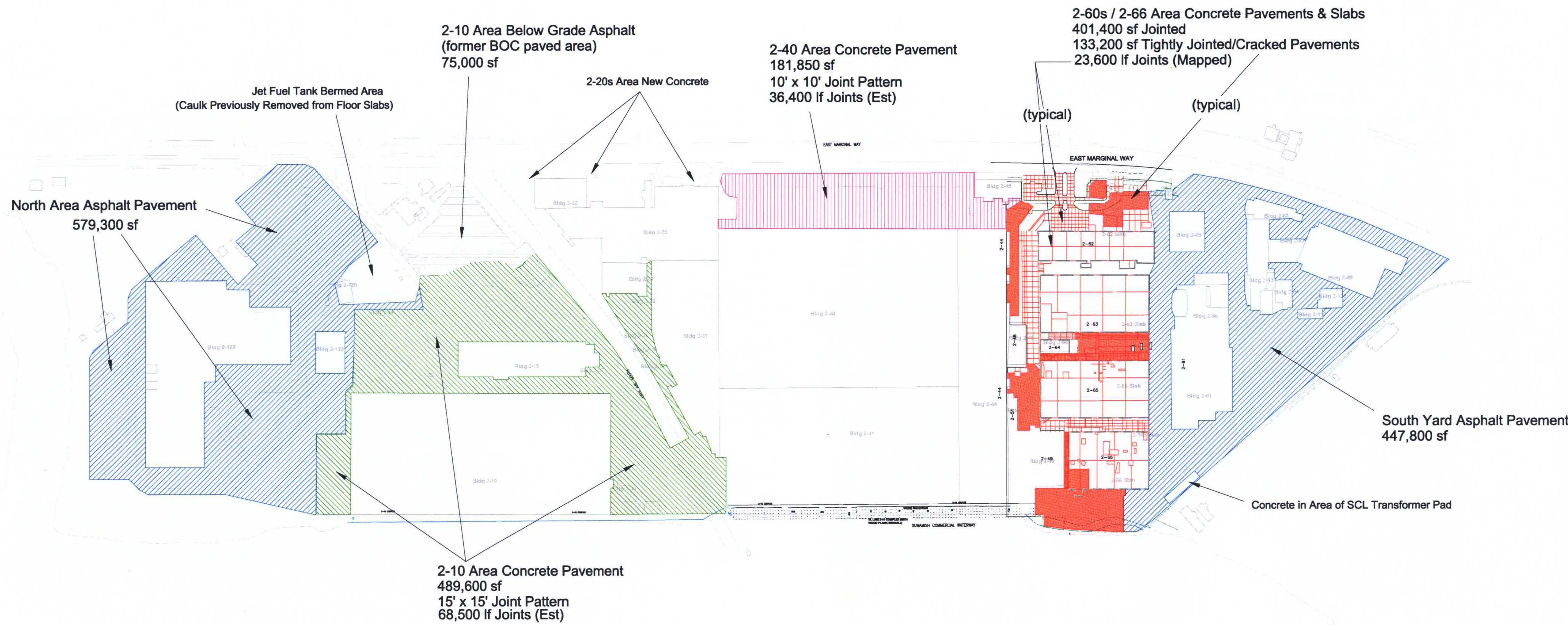
Golder Associates

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	JDD	SAM	05/17/07

Characterization of Caulk In Concrete
IM Work Plan
Boeing Plant 2
Seattle/Tukwila, Washington

Figure 1
Vicinity Map



LEGEND

- 2-60s / 2-66 AREA JOINTS IN CONCRETE PAVEMENTS AND SLABS (MAPPED JOINTS)
- 2-60s / 2-66 AREA TIGHTLY JOINTED & CRACKED CONCRETE PAVEMENT
- 2-40 AREA CONCRETE PAVEMENT
- 2-10 AREA CONCRETE PAVEMENT
- 2-10 AREA BELOW GRADE ASPHALT (FORMER BOC PAVED AREA)
- ASPHALT (RECENT PAVING)

SUMMARY OF JOINT AND AREA ESTIMATES

GENERAL LOCATION	AREA (square feet)	JOINT LENGTH (linear feet)
2-60s / 2-66 AREA JOINTED CONCRETE (MAPPED)	401,400	23,600
2-60s / 2-66 AREA TIGHTLY JOINTED/CRACKED CONCRETE	133,200	N/A
2-40 AREA CONCRETE PAVEMENT (EST)	181,850	36,400
2-10 AREA CONCRETE PAVEMENT (EST)	489,600	68,500
2-10 AREA BELOW GRADE ASPHALT - FORMER BOC (EST)	75,000	N/A
NORTH AREA ASPHALT (RECENT PAVING)	579,300	N/A
SOUTH YARD ASPHALT (RECENT PAVING)	447,800	N/A
TOTALS	2,308,150	128,500

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BOEING/PLANT 2 CAULK IM WP

GENERALIZED PLANT 2 PAVEMENTS AND SLABS

PROJECT No. 013-1846x001
SCALE AS SHOWN
CADD BPC 9/17/03
CHECK TJN 9/17/03
REVIEW KMA 9/17/03

FIGURE 2

ATTACHMENT A

FIELD SAMPLING SHEET (example)

Diagram of Sample Location

Project: IM – Caulk in Concrete

Site: Boeing Plant 2

Weather: ____________________

Sampler(s): ____________________

Sample ID: ____________________

Date: ____________________

Time: ____________________

Material Type: Joint Caulk

SAMPLE DESCRIPTION

Weathered Surface: ____

____

Fresh Cut Surface: ____

____

Consistency: ____

____

Width: ____

Depth: ____

Backer Rod: ____

Other: ____

LOCATION DESCRIPTION

____

____

Notes: [1] Associated Features / Associated Joint Types:

____

____

[2] Sample was collected using a dedicated disposable knife blade. The blade was changed for every sample. Nitrile gloves were worn and changed for every sample.